We claim a:

1. A method of adjusting an effective refractive index seen by a signal in a waveguide, the method comprising the steps of:

generating ultra-short laser pulses;

applying the signal to the waveguide for analysis thereof; and

directing the ultra-short laser pulses toward the waveguide to alter the effective refractive index of the signal in accordance with the analysis.

2. The method of claim 1, wherein the waveguide is disposed in a medium and the ultra-short laser pulses have a wavelength substantially transparent in the medium.

3. The method of claim 1, wherein the waveguide is disposed in a medium and the directing step comprises the step of directing the ultra-short laser pulses such that an affected volume of the medium is within the waveguide.

4. The method of claim 3, wherein the affected volume covers a substantial cross-sectional area of the waveguide.

5. The method of claim 4, wherein the directing step comprises the step of applying the ultra-short laser pulses such that the affected volume uniformly covers over the substantial cross-sectional area so as to induce an isotropic transverse index of refraction profile therein.

6. The method of claim 4, wherein the directing step comprises the step of applying the ultra-short laser pulses to induce an anisotropic affected volume and resultant index of refraction profile over the substantial cross-sectional area.

7. The method of claim 1, wherein the applying and directing steps are performed concurrently.

8. The method of claim 1, wherein the step of directing the ultra-short laser pulses further comprises the steps of:

measuring an output pattern derived from the waveguide, the output pattern being indicative of a performance metric of the waveguide; and

moving the ultra-short laser pulses until the output pattern indicates that the performance metric has achieved a desired level.

9. The method of claim 8, wherein the performance metric is indicative of throughput signal loss, phase dependent loss, polarization dependence, or phase dependent frequency within the waveguide.

10. The method of claim 1, wherein the waveguide is disposed in-bulk within a medium.

11. The method of claim 1, wherein the directing step comprises the step of increasing the effective refractive index of the signal over at least a portion of the waveguide.

12. The method of claim 1, wherein the directing step comprises the step of scanning the ultra-short laser pulses over overlapping segments of the waveguide to form an affected volume having a varying refractive index profile over a length of the waveguide.

13. The method of claim 1, wherein the directing step comprises the step of varying an intensity of the ultra-short laser pulses to form an affected volume having a varying refractive index profile over a length of the waveguide.

14. The method of claim 1, further comprising the step of scanning the ultra-short laser pulses to form an affected volume having a corrugated, tapered, or graded index of refraction profile over a length of the waveguide.

15. The method of claim 1, wherein the step of directing the ultra-short laser pulses further comprises the step of forming a trimmed segment adjacent to and spaced from the waveguide, the trimmed segment being formed in an optical medium, where the waveguide is disposed in the optical medium.

16. The method of claim 15, wherein the step of forming the trimmed segment further comprises the steps of:

measuring an output signal derived from the waveguide, the output signal being indicative of a performance metric of the waveguide; and

adjusting either a physical dimension or an index of refraction profile of the trimmed segment until the output signal indicates that the performance metric has achieved a desired level, the output signal being an amplitude signal.

17. The method of claim 15, wherein the step of forming the trimmed segment further comprises the steps of :

measuring an output pattern derived from the waveguide, the output pattern being indicative of a performance metric of the waveguide; and

adjusting either a physical dimension or an index of refraction profile of the trimmed segment until the output pattern indicates that the performance metric has achieved a desired level.

18. The method of claim 17, wherein the output pattern is an interferometric pattern and the performance metric is representative of the effective index of refraction for the signal propagating within the waveguide, the method further comprising the steps of:

applying a first portion of the input signal to the waveguide; and

measuring the interferometric pattern at an output of the waveguide, the interferometric pattern being derived from the first portion of the input signal and a second portion of the input signal applied to a reference waveguide.

19. The method of claim 18, wherein the reference waveguide is formed in the optical medium and the reference waveguide and the waveguide form an interleaver.

20. The method of claim 18, wherein the reference waveguide is formed in the optical medium and the reference waveguide and the waveguide collectively form an optical device selected from the group consisting of a waveguide coupler, a splitter, and a combiner.

21. The method of claim 15, further comprising the step of moving the ultra-short laser pulses to form a complementary trimmed segment that complements the trimmed segment, the complementary trimmed segment being formed within the bulk of the optical medium.

22. The method of claim 15, wherein the trimmed segment is an optical waveguide that allows signal propagation.

23. A method of improving operation of an optical device having a first waveguide and a second waveguide, the method comprising the steps of:

applying an input signal to at least one of the first waveguide and the second waveguide;

performing an analysis of an output derived from the first waveguide and the second waveguide, the output being indicative of a performance metric of the optical device; and

in response to the analysis, directing ultra-short laser pulses within the first waveguide for altering an optical characteristic of the optical device.

24. The method of claim 23, wherein the optical device is an interleaver.

25. The method of claim 24, wherein the interleaver has a waveplate extending across the first waveguide and the second waveguide, the waveplate

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having an entrance side and a exit side, and wherein the step of directing the ultra-short laser pulses further comprises the steps of:

moving the ultra-short laser pulses along a first region of the first waveguide, the first region being on the entrance side; and

moving the ultra-short laser pulses along a second region of the first waveguide, the second region being on the exit side and symmetric with the first region so as to substantially cancel any polarization dependence induced within the optical device by the first region.

26. The method of claim 24, further comprising the steps of:

moving the ultra-short laser pulses along a region of the first waveguide; and

moving the ultra-short laser pulses along a region of the second waveguide, the region of the second waveguide being formed so as to substantially cancel any polarization dependence present or induced within the optical device by the first region.

27. The method of claim 24, wherein the output is an interferometric pattern.

28. The method of claim 24, wherein the output is indicative of loss imbalance in the optical device and wherein the step of directing the ultra-short laser pulses comprises the step of:

in response to the output, applying the ultra-short laser pulses to the first waveguide and to the second waveguide for producing a balanced loss between the first waveguide and the second waveguide.

29. The method of claim 23, wherein the optical device is a splitter and wherein the optical characteristic is a splitting ratio of the optical device.

30. The method of claim 29, wherein the step of the directing the ultra-short laser pulses step is performed until the splitting ratio of the optical device is substantially equal to 50%.

31. The method of claim 23, wherein the first waveguide and the second waveguide are both formed within the bulk of the optical medium.

32. The method of claim 23, wherein the step of directing the ultra-short laser pulses further comprises the step of applying the ultra-short laser pulses within the first waveguide to modify an index of refraction within the first waveguide.

33. The method of claim 32, wherein the modification increases the index of refraction over at least a portion of the first waveguide.

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34. The method of claim 23, wherein the step of performing an analysis further comprises the step of developing a difference signal derived from an input signal.

35. The method of claim 23, wherein the performance metric is indicative of throughput overall signal loss, phase dependent loss, polarization dependence, or phase dependent frequency within the optical device.

36. A method of altering a waveguide existing within an optical medium and having an index of refraction, the method comprising the steps of:

generating ultra-short laser pulses having an effective confocal region for forming an affected volume; and

moving the ultra-short laser pulses within the optical medium such that the formed affected volume extends beyond an axial profile of the waveguide to alter the shape of the waveguide.

37. The method of claim 36, wherein the waveguide is disposed in-bulk within the optical medium.

38. The method of claim 36, wherein the waveguide is a planar waveguide.

39. The method of claim 36, wherein the axial profile is altered to form a corrugated profile.

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40. The method of claim 36, wherein the axial profile is altered to form a tapered profile having a first end and a second end, wherein the waveguide has a first cross-sectional shape at the first end that is different than a second cross-sectional shape at the second end.

41. The method of claim 36, wherein the axial profile is altered to form a tapered profile having a first end and a second end, wherein the waveguide has a first cross-sectional shape at the first end that is substantially similar to a second cross-sectional shape at the second end.

42. The method of claim 36, wherein the optical medium is an optical fiber and the waveguide is a core of the optical fiber and wherein the axial profile is altered to form a tapered pattern having a first cross-sectional profile suitable for single mode propagation and a second cross-sectional profile suitable for multi-mode propagation.

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43. A method of coupling a first waveguide and a second waveguide, wherein at least one of the first and second waveguides exists within an optical medium, the method comprising the steps of:

generating ultra-short laser pulses;

applying a signal to the first waveguide and the second waveguide for measuring an output derived from the first waveguide and the second waveguide,

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the output being indicative of a performance metric of the first waveguide and the second waveguide; and

in response to the measured output, directing the ultra-short laser pulses within the bulk of the optical medium to write a facilitator segment such that the facilitator segment is within an evanescent coupling region of the first waveguide and within an evanescent coupling region of the second waveguide.

44. The method of claim 43, wherein the first waveguide and the second waveguide are formed within the bulk of the optical medium.

45. The method of claim 43, wherein the first waveguide is disposed substantially outside the evanescent coupling region of the second waveguide over a given length of the first waveguide.

46. The method of claim 45, wherein the facilitator segment is a waveguide.

47. The method of claim 43, wherein the first waveguide and the second waveguide collectively form an optical coupler and wherein the step of directing the ultra-short laser pulses further comprises the step of adjusting the length of the facilitator segment so as to induce substantially 100% coupling between the first waveguide and the second waveguide.

48. The method of claim 43, wherein the first waveguide and the second waveguide collectively form an optical splitter and wherein the step of selectively moving the ultra-short laser pulses further comprises the step of adjusting the length of the facilitator segment so as to induce a desired splitting ratio between the first waveguide and the second waveguide.

49. An optical device, comprising:

an optical medium;

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a first waveguide disposed in-bulk in the optical medium and having a cross-sectional refractive index profile; and

a second waveguide disposed in-bulk in the optical medium and having a cross-sectional refractive index profile;

a signal transmitted in the optical device in a propagation direction;

wherein the cross-sectional refractive index profile of the second waveguide is selectively varied along the propagation direction to cooperate with the cross-sectional refractive index profile of the first waveguide to produce a desired output of the optical device.

50. The optical device of claim 49, wherein the cross-sectional refractive index profile of the second waveguide is varied to alter an axial profile of the second waveguide.

51. The optical device of claim 50, wherein the axial profile has a tapered or corrugated profile.

52. The optical device of claim 50, wherein the axial profile has an end of sufficient size to allow for coupling.

53. The optical device of claim 49, wherein the cross-sectional refractive index profile of the second waveguide is varied to vary an axial refractive index profile of the second waveguide.

54. The optical device of claim 49, wherein the cross-sectional refractive index profile of the second waveguide is varied to induce polarization sensitivity into the second waveguide.

55. The optical device of claim 49, wherein the cross-sectional refractive index profile of the second waveguide includes an anisotropic region.

56. The optical device of claim 49, wherein the first waveguide and the second waveguide are within a coupling separation distance over at least an interaction length.

57. The optical device of claim 56, wherein the first waveguide and second waveguide form an interleaver, a coupler, a combiner, or a splitter.

58. A method of forming a graduated change in the index of refraction of a waveguide, the method comprising the steps of:

generating ultra-short laser pulses; and

scanning the ultra-short laser pulses over overlapping segments within the waveguide to form a desired axial index of refraction profile within the waveguide.

59. The method of claim 58, wherein the axial index of refraction profile is a graded, step-wise, or corrugated profile.

60. An optical device, comprising:

an optical medium; and

a waveguide having a first segment and a second segment wherein the first and second segments are disposed in-bulk in the optical medium and have a respective cross-sectional refractive index profile;

wherein the cross-sectional refractive index profile of the first segment differs from the cross-sectional refractive index profile of the second segment such that the waveguide is polarization-selective.

61. The optical device of claim 60, wherein the cross-sectional refractive index profile s of the first segment and the second segment are isotropic.

62. The optical device of claim 60, wherein the cross-sectional refractive index profile of the first segment is anisotropic.

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63. The optical device of claim 62, wherein the cross-sectional refractive index profile of the second segment is anisotropic.

64. The optical device of claim 60, wherein the cross-sectional refractive index profile of the first segment has a unitary profile and the cross-sectional refractive index profile of the second segment a Gaussian profile.

65. A method of repairing a defective waveguide comprising the steps of:

(A) applying an input signal to the defective waveguide;

(B) detecting an output signal from the defective waveguide, the output signal being generated by the input signal;

(C) selecting a location associated with the defective waveguide;

(D) applying a focused ultra-short laser pulse to the selected location to modify a characteristic of the waveguide;

(E) repeating at least some of steps (A)-(D) until the output signal from the defective waveguide indicates that the defective waveguide has been repaired.

66. A method as defined in claim 65 wherein the selected location is within the defective waveguide.

67. A method as defined in claim 65 wherein the selected location is adjacent and contacting the defective waveguide.

68. A method as defined in claim 65 wherein the selected location is adjacent and spaced from the defective waveguide.

69. A method as defined in claim 65 wherein the defective waveguide is a planar waveguide.

70. A method as defined in claim 65 wherein the defective waveguide is located in bulk.

71. A method as defined in claim 65 wherein the defective waveguide is a direct-written waveguide.